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Spaceport News
John F. Kennedy Space Center - America's gateway to the universe

Inside . . .

First steps planted moon foothold

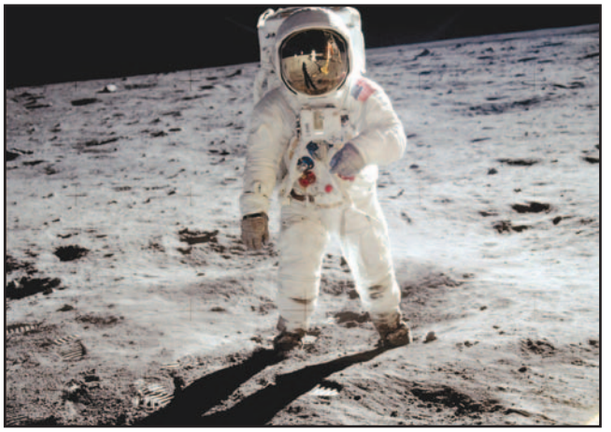
By Kay Grinter
Reference Librarian

What a difference a day makes! The Apollo 11 astronauts' sojourn on the lunar surface was a mere 21 hours, 36 minutes, but that single day made a permanent impact on the history of the human race.

The lunar module Eagle descended to the Sea of Tranquility on July 20, 1969, carrying Neil Armstrong and Buzz Aldrin into the history books. Michael Collins orbited above the moon's surface in the command module Columbia. The legs of the lunar module made contact at 4:18 p.m. EDT.

Armstrong reported to mission control, "Houston, Tranquility Base here -- the Eagle has landed," and received the reply, "Roger, Tranquility. We copy you on the ground. You got a bunch of guys about to turn blue. We are breathing again."

Armstrong took humanity's first step on the moon at 10:56 p.m. Some 600 million viewers on Earth -- one-fifth of the world population -- watched the live television transmission and heard him describe the feat as "one small step for a man, one giant leap for mankind."



NASA file/1969

In one of the most iconic images of the 20th century, Edwin "Buzz" Aldrin explores the surface of the moon during the Apollo 11 mission in July 1969.

Of course, the plan was put in motion May 25, 1961, by President John F. Kennedy in an address to Congress. However, Armstrong acknowledged in an interview for NASA's Johnson Space Center Oral History Project, the contribution made by every worker in the intervening eight years led to the success of that first landing and the reliable operation of the hardware in the Apollo Program.

"I can only attribute that to the fact that every guy in the project, every guy at the bench building something, every assembler, every inspector, every guy that's setting up the tests, cranking the torque wrench, and so on, is saying, man or woman, 'If anything goes wrong here, it's not going to be my fault, because my part is going to be better than I have to make it.' And when you have hundreds of thousands of people all doing their job a little better than they have to, you get an improvement in performance. And that's the only reason we could have pulled this whole thing off," Armstrong said.

The Eagle lifted off the moon at 1:54 p.m. July 21.

Now, 40 years later, preparations are under way for astronauts to return to the moon. President George W. Bush unveiled a new vision for space exploration in January 2004, calling on NASA to "gain a new foothold on the moon and to prepare for new journeys to the worlds beyond our own." NASA's new initiative to return to the moon was named the Constellation Program.

The designs of the launch vehicles and crew capsule envisioned for use in the Constellation Program are in progress. The Ares I and Ares V rockets are slated to carry future crews and supplies to the International Space Station and on to the moon, much as the Saturn I and Saturn V vehicles did during Apollo.

The first crewed flight of the Orion spacecraft to the space station is targeted for 2015. Altair's first landing on the moon with an astronaut crew is planned for 2020.

The hope is that another day will come when NASA can say once more: "We came in peace for all mankind."

Remember triumphs, keep looking ahead

Director's Update

Bob Cabana
Kennedy Space Center Director

Forty years ago, humans set foot on the moon for the first time, a journey of some 230,000 miles that took four days to complete and began right here on Launch Pad 39A at the Kennedy Space Center. There are some of you who were here for that historic event, but for many of our Kennedy work force, it's a memory from a grainy black-and-white TV or something they read about in history class. It's time to change that.

Kennedy is once again preparing to send humans beyond low Earth orbit in a spirit of exploration and discovery. Only this time when we return to the moon, it will be for weeks at a time instead of days, and we will be establishing the infrastructure we need to travel even further from our home planet.

On June 18, we took the first steps toward this future with the successful launch of the Atlas V rocket carrying NASA's Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite. These missions will accurately map the lunar surface and search for the presence of water-ice on the moon, preparing the way for an extended human presence.

Change is all around us at Kennedy as we prepare for the Constellation Program. In the Vehicle Assembly Building, the Ares I-X vehicle is being stacked and checked out for a flight test later this year. Modifications are being made to Launch Pad 39B to support the Ares I-X flight test and the follow-on Ares I rocket. Construction continues on the new mobile launcher for Ares I. At the beginning of this year, we held a ceremony to commemorate the activation of the Operations and Checkout Facility high bay, which will serve as the final assembly facility for the Orion crew exploration vehicle. In the facility that once processed the Apollo command and service modules for our first trips to the moon, we will now be processing the Orion spacecraft for our future trips there.

With all that's going on, it's tough to stay focused on the task at hand sometimes, but that's exactly what we must do. This means executing the remaining shuttle missions and completing the International Space Station in a flawless manner. At my last All-Hands Meeting, I made the comparison of the current status of the Constellation Program with where the International Space Station program was during its beginning. A lot can happen in 10 years; just look up in the night sky when the station is making a twilight pass overhead. I truly believe that if we can dream it, we can make it happen.

We have an amazing team here at Kennedy, and in spite of all the challenges in front of us, this is a great time to be part of space exploration. The shuttle is unequalled in what it can do, the station is nearing completion and will reach its full potential in the years ahead. The Launch Services Program leads the way in the delivery of scientific and robotic missions that pave the way for human exploration, and the Constellation Program is laying the foundation here at Kennedy to once again explore beyond the confines of low Earth orbit. None of this would be possible without your dedication and service.

So as we take time this month to remember our triumphs of 40 years ago, let's also take time to celebrate the accomplishments of today as a new generation of Kennedy workers prepare to take us back to the moon and beyond. This is a great time to be part of the Kennedy team.

Keep charging!

Bob

Background: Apollo 17 Commander Eugene Cernan adjusts the U.S. flag on the moon's surface. Apollo 17 was the seventh and last crewed lunar landing.

Ares rockets model Saturn V successful design

By Steve Siceloff
Spaceport News

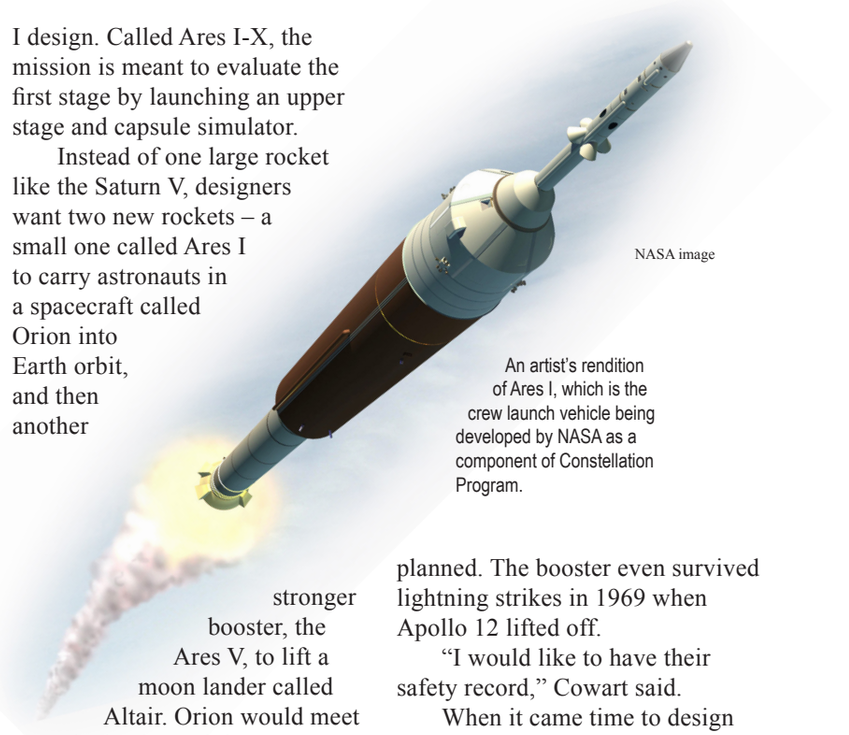
Construction dust fell all around the launch team, a reporter fell out of his chair on air and about everyone gasped as the first Saturn V roared to life and thundered off the launch pad in November 1967.

No one rode inside the capsule at the top of the massive rocket during that first test. But less than two years later, a booster just like it would propel astronauts to the surface of the moon.

For the first time since the halcyon days of Apollo, designers and technicians are engineering the first line of rockets meant to carry humanity back to the face of another world.

"Anytime you go to a new vehicle, it's exciting," said Jon Cowart, deputy mission manager for the first flight test of the Ares I design. Called Ares I-X, the mission is meant to evaluate the first stage by launching an upper stage and capsule simulator.

Instead of one large rocket like the Saturn V, designers want two new rockets – a small one called Ares I to carry astronauts in a spacecraft called Orion into Earth orbit, and then another stronger booster, the Ares V, to lift a moon lander called Altair. Orion would meet the lander and the upper stage of the Ares V above Earth and then the group would fly to the moon.



NASA image

An artist's rendition of Ares I, which is the crew launch vehicle being developed by NASA as a component of Constellation Program.

It's a tall order during a time that is far different from the 1960s, when America and the Soviet Union were in the Cold War, and space was one of the most competitive arenas.

"Everything we were doing at that time was being done for the first time," said Jack King, the voice of Apollo Launch Control.

King, who is now a communications consultant for United Space Alliance, made a special trip to see the Saturn V early on launch morning, when the towering rocket was bathed in spotlights.

"There was nothing like it," King said. "I still remember it as the most majestic thing we ever had."

The Saturn V is legendary for carrying men to the moon, but it is the gigantic rocket's reliability that most impresses the engineers designing NASA's next moon-bound boosters.

There were 13 launches of the moon rocket and no payload was ever lost. Problems developed on the second test flight with the upper stages, but the command module still came back as planned. The booster even survived lightning strikes in 1969 when Apollo 12 lifted off.

"I would like to have their safety record," Cowart said.

When it came time to design new moon missions, Cowart said the success of the Saturn V gave engineers plenty of cues to work from. Perhaps most dramatically, NASA is moving back to a spacecraft perched on top of the rocket in a capsule design such as Apollo.

"We wanted to go back to clean, simple lines," Cowart said.

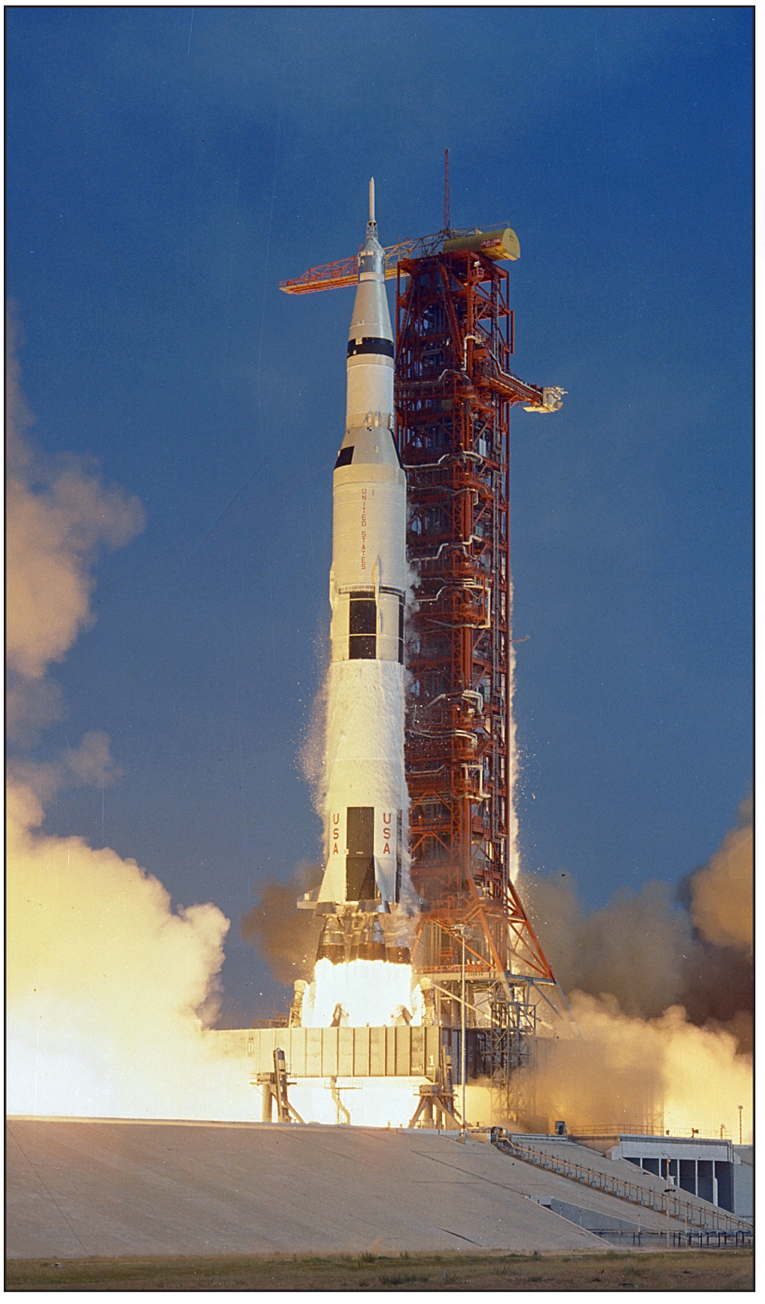
Cowart said that building another Saturn V-class booster to simply launch astronauts to the International Space Station would be a waste. By building a smaller rocket for Orion, NASA can send crews to the station while developing the large Ares V and lunar lander.

The Constellation Program aims to send more astronauts to the lunar surface than its Saturn predecessor.

Apollo saw two astronauts at a time bounce about on the moon, but Constellation envisions up to four people at a time visiting the moon.

"We'll have twice as many to the surface and staying for twice as long," Cowart said.

King said a return to the moon would be a victory for Constellation just as the moon landings made Apollo memorable. His wish for Constellation: "That they show us up and go to Mars."



NASA file/1969

Apollo 11 lifts off Kennedy Space Center's Launch Pad 39A at 9:37 a.m., July 16, 1969, with astronauts Neil Armstrong, Edwin "Buzz" Aldrin and Michael Collins aboard.

Orion encapsulates some aspects of lunar module

By Linda Herridge
Spaceport News

Forty years ago this month, three brave astronauts strapped into their Apollo capsule, dubbed "Columbia," sitting atop the massive Saturn V rocket, and began an incredible journey to the moon from Kennedy Space Center's Launch Pad 39A.

"It was exciting times," said Terry Greenfield. "We were doing something new and there were great people leading the way."

Greenfield worked on the launch vehicle boosters for Saturn I and V, and is now chief engineer for electrical systems with ASRC Aerospace.

Today, as NASA's Space Shuttle Program closes in on its final missions, the agency is ramping up the first of its next-generation space vehicles -- the Ares I rocket and Orion crew exploration vehicle.

"Orion is very similar to Apollo," said Dick Lyon, vice president and program manager for the University-affiliated Spaceport Technology Development Contract with ASRC Aerospace.

Lyon came to Kennedy in 1964, and worked on the crew and lunar modules, as well as lunar surface experiments for the Apollo Program.

Apollo and Orion share that distinctive conical shape, but the Orion spacecraft has an upper and lower level and is more than twice the size of an Apollo capsule. Orion also will have more windows than Apollo, but its ablative heat shield for re-entry will be similar.

While the Apollo capsule could accommodate only three astronauts in a very confined space, Orion will carry four astronauts comfortably to the International Space Station and the moon. The new returning capsule will land and be retrieved in the ocean like Apollo.

For Apollo 11, there were four segments totaling 80 feet high and 12.8 feet in diameter. The command module housed the crew and equipment needed for re-entry and splashdown. The service module provided propulsion, electrical power and storage for various consumables required during the mission.

Members of the Air Forces' 920th Rescue Wing secure a flotation collar on the mock-up Orion crew exploration vehicle at Port Canaveral, Fla. On top of Orion are additional flotation devices.

NASA/Kim Shiflett

NASA file/1969

The Apollo 11 crew awaits pickup by a helicopter from the USS Hornet, the prime recovery ship for the historic lunar landing mission.

The launch escape system was located atop the command module and the lunar module was located in the spacecraft-lunar module adapter below the service module.

The command module measured 10 feet, 7 inches tall with a diameter of 12 feet, 10 inches across the base. The forward compartment contained two reaction control engines, the docking tunnel and the components of the Earth landing system. Its 210-cubic-feet interior housed the main control panels, crew seats, guidance and navigation systems, food and equipment lockers, and a waste management system and docking tunnel, which left very little room for the astronauts to move around.

Apollo was equipped with a host of switches, lights and gauges. Orion will have advanced electronics, touch screens and other controls derived from space shuttle upgrades.

Components of Orion are the crew module, service module, spacecraft adapter and launch abort system. The spacecraft will weigh 60,003 pounds when docked to the space station.

During Apollo moon missions, one astronaut remained in the command module orbiting the moon, while two astronauts traveled to the surface in a lunar module. Orion astronauts will transfer from the spacecraft to the Altair lunar lander for a longer stay on the lunar surface, leaving an uncrewed, automated command module orbiting the moon.

Kelvin Manning is the Orion division chief in Kennedy's Constellation Project Office. He said there has to be a lot of confidence in the design of the crew module to allow it to orbit unattended around the moon.

"It's a giant leap," Manning said.

"This is another primary step to put us back at the top," Lyon said. "The moon is a major step and a launching platform to other places. It's an opportunity to make great strides."

Pads evolve as launching points to space

By Frank Ochoa-Gonzales
Spaceport News Editor

Every journey starts from a point A. In the case of Apollo 11, that point was 39A, as in Launch Pad 39A at NASA's Kennedy Space Center. Some flights also started at point 39B, the twin launch pad to the north.

Although Apollo retired more than three decades ago, the twin launch pads have remained active to serve as the starting line for space shuttle flights. And on launch day, there's no doubt that's where the action is.

"When you'd get to the pads right before a launch, you'd realize it was an area of high concentration," said Guenther Wendt, who was in charge of Kennedy launch tower pad operations during the Mercury and Apollo programs. "When you got to it, you realized there was a big monster living there. You had to be prepared for anything and everything."

During the Apollo era, key pad service structures were mobile. Following the joint U.S.-Soviet Apollo-Soyuz Test Project mission in July 1975. Following 12 Apollo Program launches, the pads were modified to support space shuttle operations. For the first time, two permanent service towers were installed at each pad, the fixed service structure and the rotating service structure.

On April 12, 1981, shuttle operations commenced at pad A with the launch of space shuttle Columbia on the STS-1 mission. After 23 more successful launches from pad A, the first space shuttle to lift off from pad B was Challenger's final mission, STS-51L, in January 1986. Pad B was designated for the resumption of shuttle flights in September 1988, followed by the reactivation of pad A in January 1990.

Space shuttle operations on pad B ended when Endeavour rolled over to pad A on May 31, and pad B was turned over to the Constellation Program. It is the next step in preparing the first flight test of the agency's next-generation spacecraft and launch vehicle system -- including the Ares I and Ares V launch vehicles, the Orion crew capsule and the Altair lunar lander.

The ground operations team currently is modifying pad B for the Ares I-X rocket launch.

"You have to take that first step to start any journey. It is amazing and humbling now that launch is within our grasp. And realize, what we are about to do as part of the Ares I-X team, is the first step of taking us beyond low Earth orbit again and on our way to Mars for the first time with humans," said Billy Stover, ground systems integrated product team lead.

The Ares I-X flight test is targeted for no earlier than Aug. 30.

NASA/Kim Shifflett

Three lighting towers currently surround Kennedy Space Center's Launch Pad 39B, which was handed over to NASA's Constellation Program from the Space Shuttle Program on May 31.

NASA file/1969

The Apollo 11 Saturn V rocket lights up Launch Pad 39A right after rollout at Kennedy Space Center.

Apollo 11 ‘one small step for a man, one giant leap for mankind’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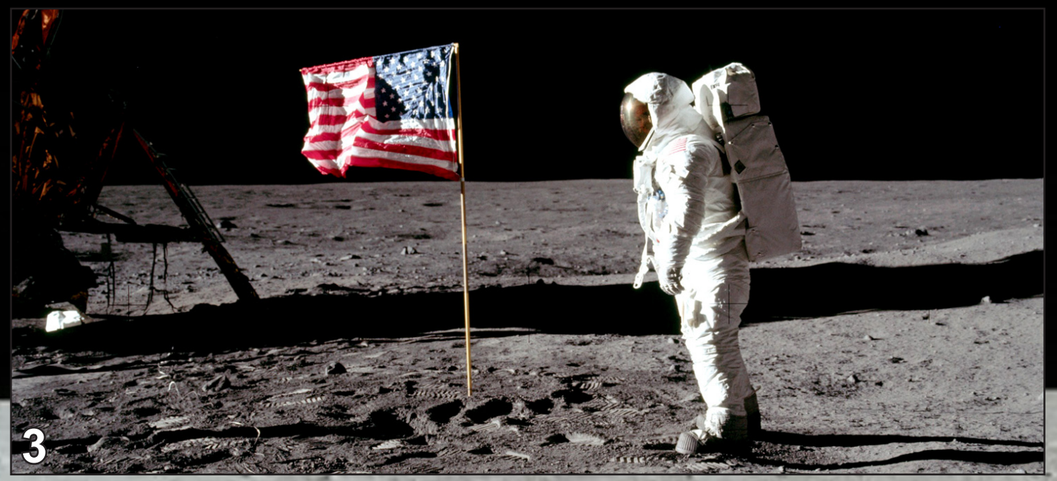
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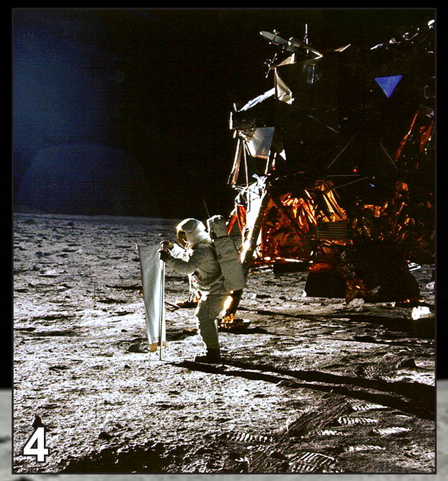
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1. A Kennedy Space Center technician works atop the White Room through which the Apollo 11 astronauts entered their spacecraft. **2.** The Apollo 11 crew conducts a compartment fit and functional check of the equipment and storage locations in their command module. **3.** Lunar Module Pilot Edwin “Buzz” Aldrin salutes the U.S. flag July 20, 1969, during humanity’s first visit to the moon. **4.** Apollo 11 Lunar Module Pilot Edwin “Buzz” Aldrin is photographed by Commander Neil Armstrong during the first spacewalk on the lunar surface July 20, 1969. **5.** Launch team members watch Apollo 11 lift off through the firing room windows at Kennedy Space Center on July 16, 1969.

6. Apollo 11 races to the moon July 16, 1969. Edwin “Buzz” Aldrin and Neil Armstrong walked on the moon’s surface four days later. **7.** The Apollo 11 crewmembers ride to the launch pad in the astronaut transport van for the Terminal Countdown Demonstration Test on July 15, 1969. **8.** President Richard Nixon welcomes the Apollo 11 astronauts back to Earth aboard the USS Hornet recovery ship. Apollo 11 splashed down in the Pacific Ocean on July 24, 1969. **Background:** Before Neil Armstrong and Edwin “Buzz” Aldrin lifted off the moon’s surface, Armstrong (shadow) takes a picture of the lunar module Eagle.

VAB always ready to stack, roll big rockets

By Anita Barrett
Spaceport News

The Kennedy Space Center of the 21st century began taking shape in the early 1960s, when new facilities were needed to assemble the moon-bound Saturn V rockets. The most impressive in terms of size was the Vertical Assembly Building, known as the VAB, standing 525 feet tall and towering over the area's skyline.

The building was renamed the Vehicle Assembly Building in 1965.

After the Saturn V, its use turned to shuttle and soon will turn to preparing the Ares I and Ares V rockets for NASA's Constellation Program.

The VAB is divided into two main sections. For the Apollo Program, eight cells used for preparing and checking out the second and third stages of the Saturn V were in the low bay section. Each cell contained work platforms that opened to receive the stage and then enclosed it. The cell's mechanical and electrical systems enabled simulation of stage interfaces and operations with other stages, as well as with the instrument unit.

The high bay section contains four bays, each large enough to accommodate a mobile launcher carrying a fully assembled space vehicle.

High bays 1, 2 and 3 were fully equipped for the Saturn V vehicles, while the fourth bay was reserved to support a higher launch rate, if required.

Five pairs of extensible work platforms of varying heights were installed on the north and south sides of each operational bay. The extensible platforms encircled the Saturn V stages during checkout and preparation. They then were retracted against the walls before the vehicle rolled out to the launch pad.

NASA/Tim Jacobs

The Ares I-X interstage 1 for the upper stage simulator is moved to the forward assembly in the Vehicle Assembly Building's high bay at Kennedy Space Center. The VAB is the fourth largest building in the world by volume and the largest one-story building in the world.

Don Phillips was chief test supervisor for the Apollo Program. Like most people who enter the VAB, he said he was "awed" by the volume of space inside.

"I often took guests on tours to the 34th level near the top, where the highest catwalk was located," said Phillips. "It was always impressive to look down at operations on the lower floors."

He added, "It also was fascinating to watch the 250-ton crane in operation." The crane was used to lift spacecraft from the transfer aisle into the high bays.

Much of the office space in the VAB's upper levels housed the checkout instrumentation of the stages. There also were 16 high-speed elevators to serve the 3,000 employees working in the VAB during Apollo.

For the Space Shuttle Program, a technological "face-lift" was needed to accommodate the shuttle vehicles, which differed significantly in size and shape from previous human space vehicles. Modifications in the VAB included major changes to high bays 1 and 3 to equip them for the assembly and checkout of shuttles. Work platforms also had to be modified to fit the shuttle configuration.

High bays 2 and 4 required internal structural changes to accommodate a vertical storage cell and a checkout cell. This also is where the 154-foot shuttle external tank waits to be mated to the shuttle.

A portion of the low bay checkout cell was converted into an enclosed, environmentally controlled workshop where orbiter main engines are received and inspected. As shuttle operations matured, the shop was moved out of the VAB near where Orbiter Processing Facility-3 is located.

In addition, the north door of the VAB was vertically modified to accommodate the tail of the shuttle as it rolls into the transfer isle from a processing facility.

Getting the VAB ready for the Constellation Program has required engineers to rethink and remeasure the space.

The Ares I on top of the mobile launcher will reach 358 feet high, compared to the approximately 225-foot-tall shuttle stack.

According to Charles Gambaro, Constellation senior project manager for VAB modifications, additional platforms will be needed at higher levels, constructed where major work will be done. The highest platform elevation will be at about 360 feet.

"The design of the High Bay 3 platforms is very close to 100 percent complete and the new platforms will look and operate totally different from existing shuttle platforms," said Gambaro. "Platforms currently used for shuttle will be removed after the high bay turnover. The new platforms to be installed will conform to the shape of the Ares I vehicle. They will be designed for the work to be done at each level."

For now, shuttles and the Ares I-X flight test segments share the VAB. After 2010, the facility will again be dedicated to preparing rockets for launches to the moon and beyond.

NASA file/1969

Inside the Vehicle Assembly Building's High Bay 1, an overhead crane lifts the Saturn V first stage for the Apollo 11 mission from the transfer aisle floor in preparation for stacking on a mobile launcher.

Constellation chutes descend from Apollo

By Elaine Marconi
Spaceport News

The Apollo Program was designed to land humans on the moon and bring them safely back to Earth. Six missions, Apollo 11, 12, 14, 15, 16 and 17, achieved this goal.

The missions that landed on the moon returned a wealth of scientific data and hundreds of pounds of lunar samples, but without a safe way to return to Earth, none of these missions would have been deemed a success.

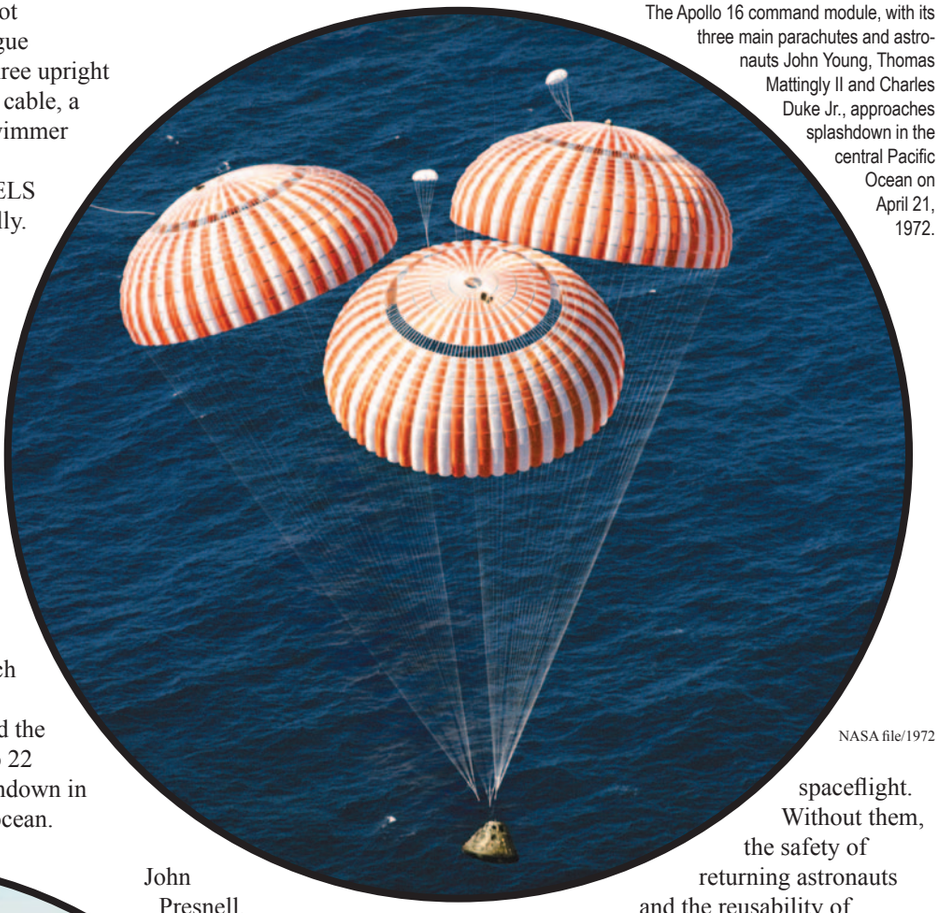
A little known, but enormously significant component of the brilliantly designed Apollo command module was the Earth landing system, or ELS -- basically a set of parachutes.

The word "parachute" comes from a French word with an ancient Greek prefix: "para," meaning against or counter, combined with "chute," the French word for fall. Parachute therefore means "against the fall."

Apollo's ELS consisted of three main parachutes, three pilot parachutes, two drogue parachute motors, three upright bags, a sea recovery cable, a dye marker and a swimmer umbilical.

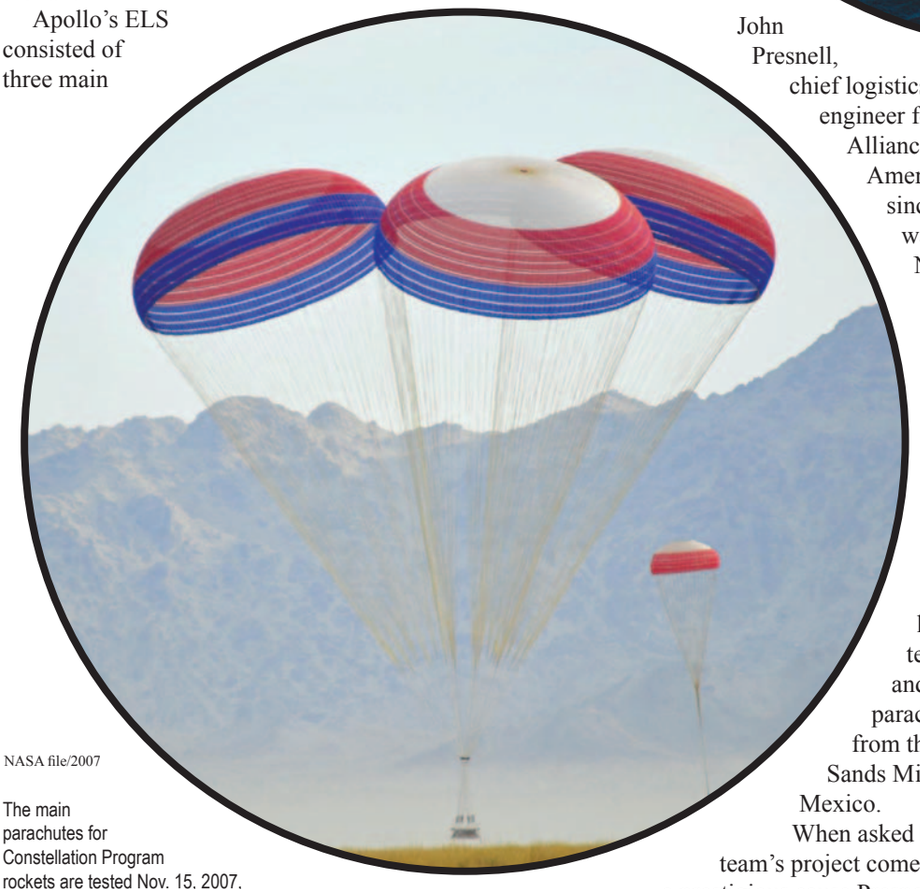
Each part of the ELS worked synergistically. About 24,000 feet after the command module's forward heat shield was jettisoned, the drogue parachutes were released slowing the spacecraft to 125 mph.

At 10,700 feet, the drogues were jettisoned and the pilot parachutes were deployed, which pulled out the main chutes. These slowed the command module to 22 mph for a soft splashdown in the ocean.



The Apollo 16 command module, with its three main parachutes and astronauts John Young, Thomas Mattingly II and Charles Duke Jr., approaches splashdown in the central Pacific Ocean on April 21, 1972.

NASA file/1972



NASA file/2007

The main parachutes for Constellation Program rockets are tested Nov. 15, 2007, over the U.S. Army's Yuma Proving Ground near Yuma, Ariz. They measure 150 feet in diameter and weigh 2,000 pounds.

John Presnell, chief logistics engineer for United Space Alliance, has been with America's space program since 1956, when NASA was still named the National Advisory Committee for Aeronautics, or NACA. Presnell was the vehicle project engineer of development for Apollo's first flight test.

Presnell was present when the Little Joe II rocket launched the Apollo test command module and newly developed parachutes May 13, 1964, from the U.S. Army's White Sands Missile Range in New Mexico.

When asked how it felt to see his team's project come to fruition for such a prestigious cause Presnell said, "It was very emotional."

Parachutes still play a major role in human spaceflight. Without them, the safety of returning astronauts and the reusability of important equipment would be impossible.

The Constellation Program has developed a super-sized version of the Apollo parachutes for the Ares solid rocket booster recovery system and Orion crew exploration vehicle.

The booster parachute recovery system consists of three enormous parachutes, each weighing in at one ton and measuring 150 feet in diameter. They are the largest rocket parachutes ever manufactured.

The successful recovery of the Apollo astronauts plucked from the ocean was a testament to the capability of the parachutes to perform nearly flawlessly. Today, they continue to provide safe landings for space shuttle solid rocket boosters.

In the future, the Ares spent first-stage motors and the Orion crew exploration vehicle will land safely on Earth, thus allowing them to be reused for future flights. This will be due to the exceptional capability of their parachute landing systems, born in the Apollo-era 40 years ago.

Lunar experiments map out pivotal steps

By Rebecca Sprague
Spaceport News

Apollo-era scientists and physicists on Earth were excited that their experiments were going to the moon, even if they weren't. During a breath-taking lunar descent by the Apollo 11 astronauts, they feared their projects might not even make it to the surface.

"The lunar module was running out of gas and in the blink of an eye the mission was going to abort," said Lee Scherer, former Kennedy Space Center director. "But Jack Garman, a computer expert in Houston, said he had seen the computer glitch during simulations, and Apollo 11 was told to continue the approach."

The Apollo Lunar Exploration Office, along with many others, breathed a sigh of relief. Scherer, who led the office at NASA Headquarters in Washington, D.C., at the time, said he helped pick out landing sites and exploration opportunities, along with acting as a liaison between NASA and Congress.

"We watched the first man step down onto the moon on a vague, rough television picture. It was breathtaking for everyone in the program," Scherer said.

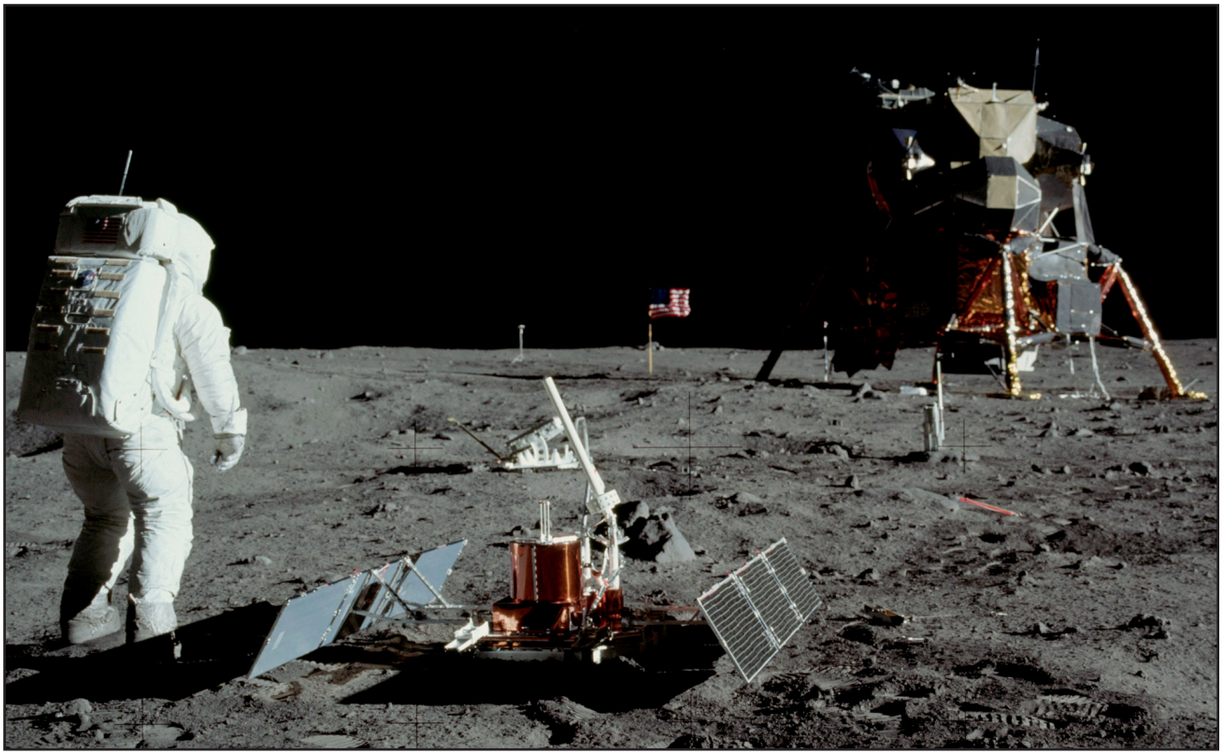
"The principal investigators were in the operations center at Johnson Space Center, just in case we were needed for troubleshooting," said Carroll Alley, a physicist whose prime experiment was packed inside the Eagle.

Alley was the principal investigator for a device called the Laser Ranging Retroreflector that the astronauts were to place on the moon.

About 100 feet away from the Sea of Tranquility landing site, moonwalkers Edwin "Buzz" Aldrin and Neil Armstrong talked about where to place that first retroreflector:

Aldrin: OK, have you got us a good area picked out?

Armstrong: Well, I think right out on that rise out there is probably as good as any.



NASA file/1969

Astronaut Edwin "Buzz" Aldrin deploys the Passive Seismic Experiment Package on the moon's surface near the Sea of Tranquility. The sensitive instrument remained on the lunar surface to radio back information about moonquakes, landslides and meteorite impacts. The Apollo 11 instrument returned data for only three weeks. More advanced seismometers were deployed at the Apollo 12, 14, 15, and 16 landing sites and transmitted data to Earth until September 1977.

NASA/Jack Pfaller

NASA's Lunar Reconnaissance Orbiter, or LRO, and the Lunar Crater Observation and Sensing Satellite, or LCROSS, include instruments to help map the moon's surface and search for signs of ice. The spacecraft launched June 18 to pave the way for future robotic and human missions to the moon.

Turns out the site Armstrong picked was perfect -- today, physicists around the world use the retroreflectors deployed on Apollos 11, 14 and 15 to measure the precise Earth-to-moon distance and to test theories of gravity.

"The retroreflectors are accessed nearly continuously, and have been for the past 40 years," Alley said. "They should last essentially forever. We worried that very fine, powder-like particles on the moon would coat the surfaces, but they continue to send back signals."

Perhaps just as important as what Apollo astronauts left behind, though, is what they brought back.

"There was a fear of not knowing what micrometeorites would do to an astronaut's protective spacesuit," Scherer said. "Apollo 12 landed beside Surveyor 3 so Pete Conrad could gather parts from the lander to be examined for micrometeorite damage after five years of exposure. The suits were determined to be sufficiently effective."

There also were the all-important moon samples that geologists turn to routinely for studies.

Johnson's Lunar Sample Laboratory Facility has a vault with hundreds of pounds of lunar rocks, core samples, pebbles, and sand and dust collected from the lunar surface.

"Scientists continue to study lunar samples and are developing a new theory for the origin of the moon not considered before Apollo went to the moon," said Gary Lofgren, lunar curator at Johnson.

In an effort to expand our knowledge of the moon, build an outpost and journey on to Mars, NASA's Exploration Science Mission Directorate recently launched the Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite. LRO is set to accurately map the moon's surface and LCROSS is designed to check for ice.

"These missions will provide information that will greatly improve the next generation of lunar science," Lofgren said.

Community feeds off Kennedy's endeavors

By Rebecca Sprague
Spaceport News

Life in the 1960s . . . bell-bottom jeans and tie-dye shirts, rock and soul, muscle cars, the beach, the moon, and a whole lot of free peace and love.

Don Phillips, chief test supervisor on Launch Complex 39 during the Apollo era, said "life was quite a bit different back then," especially on the Space Coast where the race to the moon was heating up.

At the height of NASA's Apollo Program, Kennedy Space Center employed about 26,000 people, including tenants and supporting contractors.

"When I first started at Kennedy, the average age was 30 or below," Phillips said. "It was a very youthful group that worked well together and didn't try to protect turf."

That large, youthful work force brought thousands of growing families to Kennedy's surrounding areas, fueling the local community and economy.

"Titusville was called the miracle city because it was growing so fast," Phillips said. "That's why we've got Miracle City Mall and Miracle Photo today.

"On Fridays, everyone would head to the bank on U.S. 1, which was two lanes back then, to cash their paychecks. It was so busy, police had to direct traffic. Then we'd go to Lums for a foot-long hot dog steamed in beer."

"Don went to Lums. I went to the Mousetrap in Cocoa Beach," said Bob Buckley, first a system engineer integration manager and then the contract technical manager for the Rockwell command and service module during Apollo. "Rubbing elbows with fellow workers and astronauts was something I looked forward to. We could unwind and relax because we knew we were among fellow Apollo team members."

NASA file/1969

Thousands of people camped on beaches and roads adjacent to Kennedy Space Center to watch Apollo 11 launch. An estimated one million people visited the Spaceport area to see the historic flight, the nation's first attempt to land on the lunar surface.

Reader-submitted photo

Francine's restaurant in Titusville, Fla., changed its name to Moonlight Drive-in during the Apollo Program. The restaurant on U.S. 1 still is popular among Kennedy Space Center workers.

Buckley added, "Bernard Surf in Cocoa Beach was nothing but 'pure high octane' and a hot spot for astronauts, launch teams, celebrities and the press. The camaraderie was unbelievable."

"Another good place was Harold's on the river in Titusville" said Gene Sestile, one of the lead test conductors for the Saturn IB and V launch vehicles during Apollo. "They had these big, big juicy wine burgers."

Today, a more modern restaurant by the name of New York, New York is in that same location across from the Vehicle Assembly Building on the Indian River, with a wine burger on their menu.

Business on the Space Coast was booming back in the Apollo glory days. So much so, that the original Tarzan, Johnny Weissmuller, opened up a theme park called Tropical Wonderland in Titusville. But as the Apollo Program wound down in the 1970s, so did the local economy.

"When Apollo ended and people started leaving, the guy across the street tried to sell me his house for one dollar," Phillips said. "Of course, a dollar was a lot of money back then."

Most business owners packed up, called it a day and tried to make a profit elsewhere. But there's at least one restaurant that has survived all these years: Moonlight Drive-in on U.S. 1 in Titusville.

"We started off as Francine's in about 1963 and changed the name during the moon missions," said Susan Hamed, owner of the retro restaurant. "My husband and I bought the place from his parents, and now three of our four children work here. The third generation will be here when NASA goes back to the moon."

Most everyone agrees that the success of Kennedy directly affects the success of the Space Coast. And there is one thing most Apollo alumni can agree on too, and that's that 40 years ago they worked hard and played hard.

"No exaggeration, most people really did work long hours," Sestile said. "Apollo was new and exciting, something we were all proud of. Just to participate was a once-in-a-lifetime opportunity."

Celebrate Apollo

July 16
11 a.m.
Apollo/Saturn V Center
Apollo astronauts will share stories with guests underneath a gigantic Saturn V rocket.

July 16
12:15 p.m.
Apollo/Saturn V Center
Mark the opening of the Apollo Treasures Gallery, which includes a rare collection of Apollo tools and gear.

July 16
3 to 4:30 p.m.
Astronaut Encounter Theater
Astronaut Edwin "Buzz" Aldrin will sign copies of his book, "Magnificent Desolation: The Long Journey Home From the Moon."

July 20
2 p.m.
Rocket Garden
Eat a piece of one of the world's largest MoonPies, made of 6 pounds of chocolate and 14 pounds of marshmallow.

July 20
Overnight
Apollo/Saturn V Center
Camp Kennedy Space Center attendees can camp out underneath a Saturn V rocket, meet a veteran astronaut and compete in a scavenger hunt.

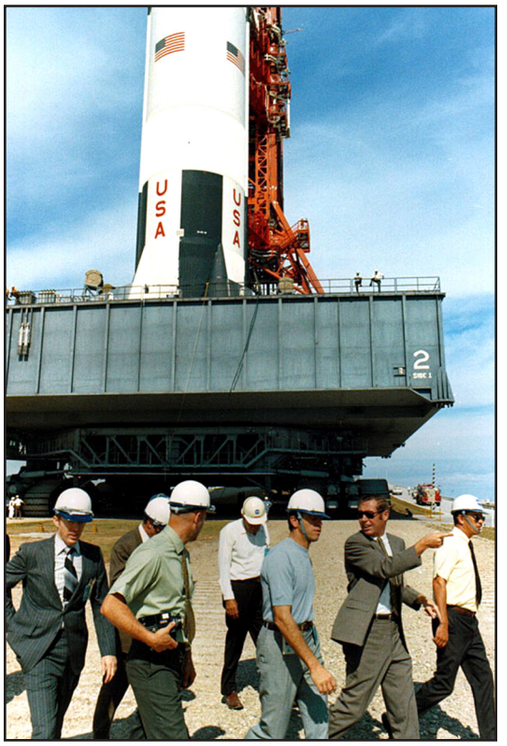
For more information, visit:
www.KennedySpaceCenter.com

Kennedy work force evolves with each program

By Linda Herridge
Spaceport News

NASA/Tim Jacobs

Technicians look closely as the Ares I-X forward skirt is mated to the forward skirt extension in the Assembly and Refurbishment Facility at Kennedy Space Center on May 17, 2009. Today, Kennedy's total work force is about 14,864, including 2,171 NASA civil servants.



NASA file/1970

Apollo 14 crew members and Kennedy Space Center officials attend the rollout of the Saturn V on Nov. 9, 1970. Kennedy's work force totaled about 16,235 at that time.

Kennedy Space Center relies on a unique and diverse NASA and contractor work force to accomplish the agency's missions. The diversity of the work force has evolved throughout the last 40 years with a wide range of occupations, ages, cultures, ethnicities, gender and disabilities.

At the onset of the Apollo Program, the work force at Kennedy was mostly male Caucasians in science, engineering, trade and labor, and technical support. Women accounted for a very small percentage of the work force and were more often in clerical and secretarial roles.

Kennedy employment peaked at 26,000 during Apollo 7 operations in 1968. When Apollo 11 launched to the moon, there were about 25,000 employees at Kennedy. Of these, 3,058 were NASA civil servants. By June 1970, Kennedy's work force had fallen to 16,235.

In 1970, Kennedy employed 55 minority civil servants. Since then, the numbers have steadily increased. By 1985, minorities made up almost 10 percent of the civil servant work force. Between 1995 and 1996, minority civil servant employees increased to 375, or more than 17 percent. By 2007, minorities accounted for 23 percent of NASA's civil servants.

Agency records reflect a total of 427 permanent female employees at NASA centers in 1972. That number fluctuated up and down through the 1970s. In 1978, of the 4,400 permanent female civil servant employees, 435 were at Kennedy. By 1995, there were 678 women civil servants employed at the center.

At the end of the Apollo Program in 1972, Kennedy's work force included 2,463 NASA civil servants and 10,456 contractor employees. In 1980, at the onset of the Space Shuttle Program, there were 2,201 NASA civil servants and 8,528 contractor employees. By 1994, there were 2,498 civil service workers with an average age of 42.8.

In 2000, the Kennedy work force was 1,739 NASA civil servants and 11,484 contractor employees. The NASA skill mix was 60.5 percent scientific and engineering; 23 percent administrative; 9 percent technical; and 7.5 percent clerical.

Today, Kennedy's total work force is about 14,864. This includes 2,171 NASA civil servants, with an average age of 43.8, and about 10,888 contractor employees.

Of the civil servants 7.7 percent are African-American; 7.4 percent are Hispanic or Latino; 4.1 percent are Asian or Pacific Islander; 3.3 percent are multiracial; .8 percent are Native American; and 6 percent are employees with declared disabilities. The civil servant skill mix is 63 percent scientific and engineering; 27 percent administrative; 6 percent technical; and 3 percent clerical.

Throughout the years, several professional organizations developed at the center with goals to improve working conditions, opportunities and recognition for minority groups.

Those include the Black Employee Strategy Team, or BEST, an organization of the center's African-American employees; The National Society of Women Engineers, or SWE, chartered the Space Coast section in 1989, to represent women engineers in Brevard, Indian River and Volusia counties; and the Disability Awareness and Action Working Group, or DAAWG, is an advocate for hiring individuals with disabilities and disabled veterans.

John F. Kennedy Space Center

Spaceport News

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